Claims

1.   A modulation/demodulation method for multi-amplitude digital modulated signals with non-equidistant phases transmitted via an orthogonal frequency division multiplexing (OFDM) communication system **characterized in that** the amplitude of said signals are separately and coherently processed, 5   whereas the phases of respectively subsequent symbols on a same subcarrier are differentially modulated and demodulated, respectively.

2.   The method of claim 1, **characterized in that** said amplitudes are coherently transmitted and are corrected in the receiver.

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3.   The method of claim 2, **characterized in that** at the demodulation stage the amplitude distortions of said multi-amplitude digital modulated signals due to frequency selectivity of the respective channel are separately corrected on each subcarrier.

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4.   The method according to at least one of the preceding claims, **characterized in that** said multi-amplitude digital modulated signals are quadrature amplitude modulated (QAM) signals.

20   5.   The method according to claim 4, **characterized in that** the correction factor for every subcarrier is determined from those QAM symbols whose phase is unique to them.

6.   The method of claim 4, **characterized in that** the correction factors for 25   the subcarrier amplitudes of said QAM symbols are computed from quadrature phase shift keying (QPSK) signals combined in one respective frame of a plurality of OFDM symbols comprising a defined number of QAM data symbols and a defined number of QPSK control signals.

30   7.   The method according to claim 4, **characterized in that** sixteen QAM symbols are adopted as said QAM signals.

8.   The method of claim 7, **characterized in that** for amplitude correction of the receiver, a running mean of the correction factor is performed over a defined time window.

1   9.   The method of claim 4, **characterized in that** a frame structure is adopted comprising nQPSK symbols followed by m 16 QAM symbols.

     10.   An orthogonal frequency division multiplexing (OFDM) system for trans-
5   mission of a multi-amplitude digital modulated signal from a transmitter to a receiver via a radio channel **characterized in that**
     - on the transmitter side, phase differential encoder means (5) are provided for differentially modulating subsequent symbols on the same subcarrier,
10   - on the receiver side, differential phase decoding means (21) are provided for demodulating said respectively subsequent symbols on said same subcarrier, and in that
     - means are provided on said both sides for coherent processing of the amplitudes of said signals.
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     11.   The OFDM system of claim 10, **characterized in that** said transmitter is adapted to process a coded data stream with a block frame structure consisting in each frame of a sequence of n quadrature phase shift keyed (QPSK) conrol symbols followed by m sixteen quadrature amplitude modulated
20   (16 QAM) data symbols and comprising
     - a demultiplexer means (1) for separating said control symbols and said data symbols, and
     - for feeding said control signals to QPSK modulator means (2) for mapping of two bits each into QPSK complex symbols and for supplying said
25   data symbols to a 16 QAM modulator means (3) for mapping of four bits each into 16 QAM complex symbols,
     - first multiplexing means (4) for multiplexing said QPSK complex symbols and said 16 QAM complex symbols and for supplying the resulting data stream to
30   - a phase differential encoder means (5) for differential modulation of the phases of respectively subsequent symbols on a same subcarrier and keeping the respective amplitudes of said symbols unchanged,
     - second multiplexing means (7) for transferring the resulting data symbol stream into OFDM signals that are subject to an inverse fast Fourier
35   transformation (8) to produce a baseband OFDM-modulated signal,
     - quadrature modulator means (10) for modulating said baseband signal with carriers having 90° phase difference and supplying the thus modulated

1 signal to

- D/A-converter means (11) followed by an up-converter means (11) to hook the analog D/A-converter output signal to a given carrier frequency for transmission.

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12. The OFDM system of claim 11, **characterized in that** null symbol generating means (6) are provided for setting unused subcarriers leaving said phase differential encoder means (5) at the band edges to zero.

10 **13.** The OFDM system of claim 11 ~~or 12~~, **characterized in that** for reducing multipath interference effects a guard interval inserting means (9) is provided for inserting before each symbol a copy of a defined numer of the last samples of the inverse fast Fourier transformed time domain OFDM symbols.

15 **14.** The OFDM system of ~~any of the preceding~~ claims 10 ~~to 13~~, **characterized in that** said receiver is adapted to receive, process and demodulate said radio channel transmitted signal and comprising:

- a down-converter means (14) for converting the received signal from said carrier frequency down to an intermediate frequency;

20 - analogue-to-digital converter means for digitizing said intermediate frequency signal;

- a quadrature demodulator means (16) for detecting and generating a baseband signal from said A/D-converted intermediate frequency;

- a time synchronizing means (17) for generating a window for fast

25 Fourier transformation indicating the effective symbol portion of the OFDM signal;

- fast discrete Fourier transformation means (18) for producing complex frequency domain symbols of said effective symbol portion of the OFDM signal;

- first demultiplexer means (19) for demultiplexing the FFT transformed

30 OFDM signal into useful data and for cancelling unused subcarriers at the band edges;

- phase differential decoder means (21) for demodulating the phases of subsequent symbols on the same subcarrier with simultaneous coherent processing of the amplitudes;

35 - second demultiplexer means (22) for separating QPSK symbols and QAM symbols;

- QPSK demodulator means (26) for demapping of said QPSK complex

1   symbols into corresponding bits;

  - QAM demodulator means (27) for demapping of said QAM complex
symbols into corresponding bits; and

  - third multiplexing means (28) for multiplexing of said demodulated
5   QPSK bits and said demodulated QAM bits according to the adopted frame
structure.

15.   The OFDM system of claim 14, **characterized in that** the QPSK complex
symbols output from said second demultiplexer means (22), on the one hand,
10   · are sent via hardlimiter means (23) to said QPSK demodulator means (26) and,
on the other hand are sent to an amplitude distortion determining mean for
generating a running mean of the respective QPSK signal, and in that the QAM
complex symbols output by said second demultiplexer means (22) is supplied
to an amplitude correction means (25) for amplitude correction according to
15   the respective running mean of amplitude before supplying the amplitude cor-
rected QAM complex symbols to said QAM demodulator means (27).

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